

REMARKS

Claims 1 and 6-7 have been amended. Claims 1-7 are presently pending.

The Examiner's allowance of claim 2 is acknowledged.

In view of such amendments and the following remarks, reconsideration and allowance of the claims, as presently presented, are respectfully requested.

EXAMINER'S ACTION

The 35 U.S.C. § 103 Rejections

Claims 1 and 3-7 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fuest, R., *Integrated Optical Michelson-Interferometer with quadrature phase demodulation in glass for displacement measuring*, TM Technisches Messen 58, No. 4 (April 1991), pp. 152-157 ("Fuest"). Independent claims 1 and 6-7 as amended, and claims 3-5 which depend from claim 1, clearly are patentable over Fuest.

Amended independent claim 1 is directed to an apparatus for measuring an optical path length difference between first and second light paths including, in relevant part, "an at least three-way coupler to combine light from the first and the second paths with each other in at least three combinations with at least three mutually different added relative phase displacements." Claim 1 requires that a detector measures "interference intensities of the at least three combinations". Further according to claim 1, "a calculation unit" calculates, "from the measured intensities, a phase difference between the light from the first and second paths." In addition, claim 1 requires that the calculating by the calculation unit is performed "using a mathematical relation which includes the measured intensities and while eliminating an effect of a contrast between the light from the first and second paths." Advantageously, the inventive apparatus

calculates a phase difference between the first and second optical paths using the three interference intensities measured at the output of a three-way coupler, where the calculation eliminates the effect of contrast between the light from the two paths, such that the path length difference between the two paths can be controlled (eliminated) without performing the complicated measurements generally required to determine the amplitude ratio (contrast) between the light from the two paths. (See specification, for example, page 2, lines 9-24). Thus, the optical path length difference between the two paths can be determined from the phase difference where the contrast is unknown, because, according to claim 1, the phase difference is calculated based on the measured interference intensities at the outputs of the three-way coupler and while eliminating the effect of contrast. (See specification, for example, page 2, lines 20-28, page 5, lines 16-17, and page 6, lines 13-15). In other words, the claimed invention provides that it is possible to accept some contrast between the first and second paths and still accurately determine the phase difference, because the calculation of the phase difference eliminates the "effect" of contrast.

In the Action, the Examiner again admitted that Fuest fails to disclose a calculation unit that eliminates an "effect" of contrast between light from the first and second paths. It is acknowledged, as noted by the Examiner, that it is desirable to provide for zero contrast between the light from the first and second paths, such as by actually preventing contrast as much as possible, for determining the phase difference. As also noted by the Examiner, Faust actually eliminates contrast "in the [optical coupling] device of Fuest through its normal operation." The "well known desire to have zero contrast" when determining path length difference between light from first and

second paths, which Faust addresses by actually eliminating contrast within the Faust device itself, however, is not the same as providing a means (device) that calculates the phase difference between the two paths from specified, measured interference intensities and where an "effect" of contrast is eliminated as part of the calculation of the phase difference. The claimed invention does not eliminate a contrast between light from the first and second paths within the light transmission device itself that is coupled to the paths, as in Faust. In amended claim 1, the "effect" of contrast is eliminated by using the measured interference intensities in the calculation of the phase difference.

Thus, claim 1 explicitly recites "how" the "effect" of contrast is eliminated, namely, a calculation is performed using the measured interference intensities of the at least three different combinations of light which are produced by an at least three way coupler and which are detected by a detector. It is respectfully submitted that Fuest does not disclose or consider accepting some contrast between the two paths, as provided for by the claimed invention. Nowhere does Faust teach or suggest (i) using the interference intensities measured at the at least three outputs of the coupler to calculate the phase difference between light from the first and second paths; and (ii) calculating the phase difference using a mathematical relation which includes the measured intensities and while eliminating the effect of a contrast between the light from the first and second paths, as required by claim 1.

Accordingly, claim 1 is patentable over Fuest.

In addition, independent method claim 6 and product claim 7, each of which includes limitations corresponding to those of amended claim 1 discussed above concerning the calculation of a phase difference between the light from first and second

paths using the interference intensities and while eliminating an effect of the contrast between the light from the first and second paths, also are patentable over Fuest for the same reasons as set forth above with respect to claim 1.

Further, claims 3-5, which depend directly from claim 1, are also patentable over Fuest for the same reasons as set forth above with respect to claim 1 and because of the further restrictions they add.

Withdrawal of the Section 103 rejections is, therefore, respectfully requested.


CONCLUSION

For the foregoing reasons, it is believed that all of the claims, as presently presented, are patentable.

The Examiner is invited to telephone the undersigned if it is believed that further amendment and/or discussion would help to advance the prosecution of the present application.

Reconsideration and allowance of claims 1-7 are, therefore, respectfully requested.

Respectfully submitted,


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